

DESIRED FUTURE HABITAT CONDITIONS IN POOL 2, MISSISSIPPI RIVER

DESCRIPTION OF POOL 2

Pool 2 is an impoundment of the Mississippi River resulting from the construction of Lock and Dam 2 at Hastings, MN. Construction of lock and dam 2 was completed in 1930. The concrete portion of the dam is 722 feet long and the earthen embankment is 3000 feet long. Due to settlement of the lock walls, a new lock was constructed in 1948 adjacent to the original lock. The lock is 110 feet wide and 600 feet long. In 1939, Lock and Dam 2 was incorporated into the 9-foot channel navigation project. Over 11,000 barges carrying over 11 million tons of materials pass through the lock annually, consisting mostly of farm products. About 12,000 recreational boats also use the lock each year. A 4.4 megawatt power plant, owned and operated by the City of Hastings, was placed in the dam in 1997. This is the most engineered stretch of the Mississippi River in the St. Paul District and includes over 300 wing dams constructed prior to the 9-foot channel project.

Pool 2, for the purposes of this plan, includes that reach of river from Lock and Dam 1 (river mile 847.6) downstream to Lock and Dam 2 (river mile 815.2) and includes the Minnesota River from Savage to the confluence with the Mississippi. All the communities along this stretch of the river are located in Minnesota and include Minneapolis, Fort Snelling, Saint Paul, Bloomington, Eagan, Burnsville, Savage, Mendota Heights, Mendota, Lilydale, South St. Paul, Newport, Inver Grove Heights, St. Paul Park, Cottage Grove, Rosemount, Grey Cloud Island Township, Ravena Township, Nininger Township, Denmark Township and Hastings. In general, the lateral boundaries of the Pool 2 planning area are the tops of the river bluffs on either side of the river, including its floodplain and that of its tributaries where they enter the Mississippi. The Pool 2 area encompasses 9,652 acres.

As is Pool 1, this Pool is in the Mississippi National River and Recreation Area, a National Park unit, and the state-designated Mississippi River Critical Area. Portions of the Minnesota Valley National Wildlife Refuge and Fort Snelling State Park are also within Pool 2.

This Pool is entirely within the state of Minnesota and represents a significant corridor of open space, aquatic areas and floodplain forests that provide important and unique habitats in an urban, suburban and rural setting for both aquatic and terrestrial plants and animals. Significant habitat features in this area include:

- * the floodplain forests of Hidden Falls-Crosby Farm and Lilydale-Harriet Island Regional Parks;
- * the 14,000 acres of forest, marsh and wet meadows of the Minnesota Valley National Wildlife Refuge;
- * the historic sites, lakes, forested floodplain and bluffs of Fort Snelling State Park;
- * a major rookery for herons and egrets that has been designated as the 100-acre Pig's Eye Island Heron Rookery Scientific and Natural Area (SNA);
- Pigs Eye Lake, a winter eagle use area at the outlet of the regional wastewater treatment plant
- Pig's Eye SNA;
- * prairie and oak savannah remnants in Grey Cloud Island Township, including Grey Cloud Dunes SNA;
- * unique aquatic habitats in Grey Cloud channel;
- * land proposed for a regional park on Lower Grey Cloud Island;
- * native plant communities within the proposed 950-acre Pine Bend Bluff SNA;
- * migrating waterfowl feeding and staging areas at Baldwin and Spring Lakes;
- * Spring Lake Regional Park;
- * six bald eagle breeding territories; and
- * three peregrine falcon nest sites.

Prior to construction of the locks and dams, the rapids and gorge area that began at St. Anthony Falls (Pool 1) continued downstream as far as the Minnesota River.

Like most navigation pools of the Upper Mississippi River, the water area in the pool is greatest at the downstream end of the pool, in the impounded area that was submersed by Lock and Dam 2 at Hastings. At the upstream end of the pool, the land area in the floodplain increases. An exception to this is the area between the I-494 bridge at South St. Paul and Newport upstream to Harriet Island in St. Paul. Along this part of the river, levees and fill have eliminated a considerable amount of floodplain in places such as Holman Field airport, which was once a marsh. Immediately below Lock and Dam 1, the river is less influenced by impoundment and more influenced by the gate adjustments at the dam and releases for hydroelectric power that control the water flow and the water level.

The Minnesota River is the only significant tributary to the Mississippi River within the Pool 2 area and has a profound effect on both the size and water quality of the Mississippi below the confluence. Small tributary creeks that contribute flow are Minnehaha, Phalen, Fish and Battle Creeks.

Some significant floodplain lakes exist within the Pool 2 area, including Black Dog, Gun Club and Long Meadow Lakes along the Minnesota River, and Pickerel, Crosby, Pigs Eye, and River Lakes in the St. Paul portion of the Mississippi. Below St. Paul, Baldwin, Mooer's, Lower Mooer's, and Spring Lakes are among the most significant migratory waterfowl feeding and resting areas along the river.

Improvements in wastewater treatment over the past two decades have allowed much of this reach of the river to again support aquatic life, including an emerging world-class game fishery and a rebounding mussel community. As a result, this area is now attracting greater recreational use.

DESCRIPTION OF POOL 2 SUBAREAS

There are five distinct areas within the Pool 2 Reach. These areas, described below are referenced in subsequent discussion of goals for desired future habitat conditions and actions that would achieve or address those goals.

Minnesota River Valley – The Minnesota River channel flows through the broad valley cut by glacial river Warren, a river that was many times the size of today's river. From Savage (the upstream limit of the 9-foot channel project) to its confluence with the Mississippi River at Pike Island (14.7 river miles), the Minnesota River is managed for commercial navigation as a part of the 9-foot channel project. Several agricultural product shipping facilities are located in the upstream portion of the area. The Black Dog Power Plant, owned and operated by Xcel Energy, is located at river mile 8.8. Fort Snelling State Park and the Minnesota Valley National Wildlife Refuge occupy most of the river's floodplain and are managed for wildlife and native plant communities. The Minnesota River floods frequently and its water carries a heavy load of sediment, nutrients and other contaminants that are associated with intensive agricultural land use, wetland drainage and subsurface tiling in its watershed.

Gorge Area (from Lock and Dam 1 to the confluence of the Mississippi and Minnesota Rivers; a continuation of the Gorge Area starting in Pool 1). Here the river flows for 3.7 miles through a steep-sided gorge, over what was once a rapids flowing downstream from St. Anthony Falls in Pool 1. Impoundment of Pool 2 and excavation of the riverbed provides for the 9-foot navigation channel. Rocks and ledges that formed the rapids have been submerged or removed. Improved water quality during the past two decades has promoted a partial recovery of fish and mussel species that had died out as a result of polluted water. Many fish still attempt to migrate up the

Mississippi and are frequently concentrated below Lock and Dam 1. Hidden Falls Regional Park is located in this subarea. Because it is not dominated by the influence of the Minnesota River, the gorge area is limnologically distinct from the rest of Pool 2. A former flowing channel of the Minnesota River (now called Snelling Lake) enters at the upstream end of Pike Island. Bluffs line the top of the gorge area and are important habitat features for resident and migratory birds. The Watergate Marina across from Pike Island, providing recreational access to the river.

Downtown St Paul and Industrialized Area – (Extending from the mouth of the Minnesota River to the I-494 Bridge at Newport and South St. Paul) Several floodplain lakes are within this 11.5-mile-long subarea: Crosby, Pickerel and Pigs Eye. Floodplain forests and natural shorelines in Hidden Falls-Crosby Farm and Lilydale-Harriet Island Regional Parks, Battle Creek Park Preserve on the shores of Pigs Eye Lake, and a bald eagle winter roost and heron rookery found within the Pigs Eye Scientific and Natural Area represent the best natural habitat in this stretch. A significant extent of the floodplain in the downtown area has been filled for development, most notably the St. Paul Downtown Airport (Holmen Field) – a former river marsh. From River Mile 841 to River Mile 836, the river's banks are armoured with rock, steel sheet piles or concrete walls, nearly eliminating riparian habitat. This five-mile stretch of river is one of the largest gaps in riparian habitat upstream of St Louis, Missouri. Pigs Eye landfill, although closed to dumping for about 30 years, continues to pose a significant threat to human health and to the health of the aquatic ecosystem. Today, it remains the largest source of contaminants in the entire Upper Mississippi River basin. Barge traffic, barge fleeting and recreational boating in this area are intense. Several passenger packet boats operate from the Harriet Island area and barge fleeting is especially intense from Lambert's Landing (RM 839.3) to just below the outlet of Pig's Eye Lake (RM 833). Fleets of barges often occupy a significant percentage of the river's surface along this stretch. Pigs Eye Wastewater Treatment Plant, the largest such facility in Minnesota, is located in this area as well and discharges a volume of effluent to the river that can equal the discharge of the Minnesota River when it is low.

I-494 Bridge to Lower Grey Cloud Island – In general, the area downstream of I-494 is in a more natural condition than the downtown area, with the exception that well over one hundred wing dams keep the flow somewhat channelized.. As the river flows out of St. Paul and the industrialized area, its floodplain broadens in this 13-mile-long subarea to include several flowing side channel areas, wooded islands, floodplain ponds and River, Baldwin, Mooers and Spring Lakes. Ashland Oil Company operates a storage area in St. Paul Park adjacent to the navigation channel. A mosaic of flowing side channels, ponds, islands, forest and rock cliffs lie along the left descending bank from RM 829.5 to RM 827.7. Upper Grey Cloud Island includes an active limestone quarry where the limestone is crushed into various sizes and shipped by barge upstream to St. Paul and Minneapolis. Grey Cloud Island includes a gravel mining operation that ships aggregate upstream to St. Paul and Minneapolis from a loading terminal at Baldwin Lake. The remainder of Baldwin Lake is quite shallow and supports considerable numbers of migrating waterfowl in the fall and spring. Grey Cloud Channel separates both Upper and Lower Grey Cloud islands from the mainland and is cut off from river flow by County Road 75 at its upstream end. It is fed by groundwater along most of its length. Clear water in this channel allows for considerable aquatic plant life and is excellent fish habitat. Mooers Lake separates Upper and Lower Grey Cloud Islands by its connection with Baldwin Lake. It is usually turbid, as is Baldwin Lake and the lower half of Mooers Lake, where it connects to the Mississippi River main channel.

A gravel mine is proposed at the off channel area at the southeast end of Lower Grey Cloud Island, where a large deposit of gravel underlies the riverbed. Spring Lake occupies the floodplain across the main channel from Grey Cloud Island. Formerly a marsh, the creation of pool 2 has made Spring Lake a shallow, turbid lake dominated by planktonic algae that appears to restrict aquatic plants to the shallowest areas. Near the upstream end of Spring Lake, a barge loading/unloading facility is operated in conjunction with a Koch (*note—need to get new name for Koch*) petroleum refinery. A channel has been dredged to allow access to the facility from the navigation channel.

Lower Impounded Area – The river from Lower Grey Cloud Island to Lock and Dam 2 (4 miles) is the portion of pool 2 most affected by impoundment. Here, land submerged by impoundment has become a shallow water area swept by wind- and boat-generated waves, preventing aquatic plants from taking root. Side channels are also submerged and slowly filling with sediment. Approximately 37 wing dams and miles of revetment submerged by the impoundment keep the higher velocity river flow in the main navigation channel area. High areas built by the river as natural channel levees or barrier islands) remained above the water surface for a number of years, but most have been eroded away by wave action. Spring Lake Regional Park sits atop the bluffs on the south side of the river. Lock and Dam 2 and its earthen dike define the downstream limits of this stretch of river.

UNIQUE ATTRIBUTES, OPPORTUNITIES AND CONSTRAINTS

Increasingly, communities along pool 2 are recognizing the recreational and aesthetic opportunities that the river provides. In St. Paul, redevelopment is converting former industrial sites to residential and business uses, with public parks and access to the river. Some developments include features to help retain stormwater, protect water quality and provide habitat and public open space. Smaller communities, such as St. Paul Park, are improving city parkland along the river to provide more access to natural areas, such as floodplain forest. Regional parks along the river are changing their policies to encourage more natural vegetation along trails and in undeveloped areas. Private landowners are also increasingly interested in revegetating shorelines and planting native vegetation on their riverfront property. In the watershed, groups are working to establish greenbelts along tributaries and restore ecological function. Examples are Phalen Creek, where citizen groups have been working with public agencies to create a greenway and re-establish a connection to the Mississippi River, and Battle Creek Regional Park, where volunteers and non-profit organizations are helping the Ramsey County Parks Department restore habitat near the river. These and other projects along the river, its tributaries and in the watershed are consistent with goals of the Pool Environmental Plan.

In the future, it will be important to continue protection of the unique ecological features described above, such as the floodplain lakes and forests of the Minnesota Valley National Wildlife Refuge and other floodplain habitat for migrating waterfowl, heron foraging, and bald eagle breeding, feeding and roosting, and the large heron rookery at Pigs Eye Lake. Bluffs in portions of pool 2, such as at Robinson's Rocks and Pine Bend, are another unique feature of this pool. They will be protected by enforcement of existing state Critical Area standards for bluff protection, and in some cases, through easements or acquisition from willing sellers. Privately owned river islands and other riparian areas will be protected by the same means. Because of the sensitive nature of islands and riparian areas, their vulnerability to physical damage and disturbance by large watercraft, marina development and expansion will be limited and surface use regulated to protect the river at critical sites. As proposed in existing regional and local plans, a new park reserve will be established on Grey Cloud Island, providing a significant new recreational opportunity as well as wildlife habitat areas.

The lower Minnesota River and the Mississippi River in pool 2 once supported more than 40 species of freshwater mussels. Migratory fish also moved through this reach on their way to spawning grounds and wintering areas. With improvements to water quality and the physical integrity of these rivers, there will be opportunity to re-establish populations of lost aquatic species. Already, a significant trophy walleye fishery has developed in pool 2. Several trout streams have been degraded but will be restored in the future. Within the valley of the Minnesota River, unique calcareous fens once supported unique plant communities. Residential development has altered the natural hydrology of these fens and all are now either gone or severely impaired. This hydrology will be restored and the fen plant communities will re-emerge.

In the future, water surface users will recognize that their activities can cause bank erosion and resuspend sediments that reduce water clarity and mobilize nutrients and other contaminants that

are harmful to aquatic life. User conduct will prevent these impacts in the future and respect the rights of other users to enjoy the river.

It is beneficial that pool 2 is within the state-designated Mississippi River Critical Area and the federal Mississippi National River and Recreation Area. Minnesota Department of Natural Resources and National Park Service goals and activities in support of these designations are generally consistent with the Pool 2 goals and can help achieve pool plan goals. Many other agency programs and initiatives and those of non-profit organizations can also help achieve goals—for example, the Metropolitan Council's Pool 2 Initiative.

SUMMARY OF POTENTIAL ACTIONS TO ACHIEVE DESIRED FUTURE HABITAT CONDITIONS

Goals for improving habitat conditions in all of the above-mentioned sub-areas of pool 2 are consistent with goals for all pools of the Upper Mississippi River system, (Pools 1-10 Reach), as identified by the Upper Mississippi River Conservation Committee. Accomplishing the 9 goals listed below will require five primary tasks: 1) promote watershed management programs on tributary streams; 2) manage for more natural water levels by restoring or mimicking the natural range of variations that would occur seasonally; 3) reconstruct islands in the lower pool; 4) modify or remove side channel closures, wing dams, lock and dam spillways, and other structures; and 5) acquire lands or floodway easements from willing sellers and restore these areas to native prairie, marsh, or forest.

1. IMPROVE WATER QUALITY

Wastewater treatment plants will be upgraded to further improve water quality, including removal of phosphorous and organic and inorganic contaminants. Endocrine mimicking chemicals that are feminizing male fish pose ominous threats to human health and the future of all river animals. In the future, it would be desirable to eliminate discharge of storm water from suburban and urban areas directly into the river. This would be done by directing water through detention ponds and restored wetlands to remove sediments and nutrients and reduce the magnitude of runoff into the Mississippi River. It would also be desirable to upgrade wastewater treatment plants upstream of this area to remove phosphorous, endocrine mimicking hormones and other organic and inorganic contaminants.

Ideally, water entering from the Minnesota River in the future would carry bed sediment, nutrients and suspended sediment loads more typical of the pre-industrial river--about 10 percent of the levels carried during the 20th century. Flows from the Minnesota River would be within the natural range of variability that characterized the pre-industrial river and reflective of a watershed in a sustainable balance with human uses. The Minnesota River would be a cleaner and more stable river that can once again support the aquatic life present 150 years ago.

River water would meet or exceed Clean Water Act standards. Pigs Eye landfill, a significant contaminant source to the Upper Mississippi River, would no longer contribute contaminants to the river. Battle Creek would be rerouted away from the landfill and aquatic plants would re-colonize Pigs Eye Lake while maintaining a functional connection to the river. Wave action in backwater lakes such as Pigs Eye would be reduced to prevent resuspension of sediments, permitting light to penetrate the lake water sufficiently to sustain aquatic plant beds. Contaminated and nutrient rich sediments that have settled in backwater lakes would be contained beneath clean sediments and remain inaccessible to the aquatic food chain. The lakes would develop better marsh and submergent plant communities, with a return to more natural water level variability. Reduced nutrient and sediment pollution from the Minnesota River and urban stormwater would significantly benefit human health and recreation opportunities and all

aquatic life in this area. "Brownfield" areas of the floodplain would be cleaned up and re-colonized by native plants.

As opportunities arise, it would be desirable to relocate industries that are not dependant on the river. This would permit pollutants to be better isolated from the river, protecting against accidental spills. Previous spills would be cleaned up. Threats from industrial facilities such as refineries and mines would diminish if facilities could be isolated from the river and/or operations modified.

Fish consumption advisories would no longer be needed.

2. REDUCE EROSION, SEDIMENT AND NUTRIENT IMPACTS

Watershed management programs should be encouraged to promote good land use that will reduce sediment and nutrient inputs into the Mississippi River. In the future, it is desirable to have well-conceived, multi-disciplinary watershed management efforts, such as the Chain of Lakes Clean Water Partnership (of Minneapolis), throughout the corridor. It is desirable to reduce sediment delivery from the Minnesota River to around 10% of present levels. The natural hydrologic regime will be restored as an outcome of watershed improvements. This will be accomplished by modifying agricultural drainage projects to retain water and nutrients on the land and by reducing row crop acreage to a sustainable level, especially in the Minnesota River basin. A buffer zone of native plant communities would intercept sediment and nutrients flowing from agricultural fields and urban areas. It would be desirable to restore such buffers on both riverbanks and up tributary rivers and streams, including those of first order magnitude, and drainage ditches. Urban sewage and stormwater treatment are integral to watershed management and will include removal of phosphorous and endocrine mimicking hormones. Sanitary sewer effluent would enter the river at a quality usable as a water supply for downstream municipalities. Contaminants in the Pigs Eye landfill will be sequestered from the river to prevent them from entering the food chain.

Water surface users will recognize that their activities can cause bank erosion and resuspend sediments that reduce water clarity and mobilize nutrients and other contaminants harmful to aquatic life. Users will modify their use of the resources to prevent these impacts in the future. In the Minnesota River, commercial navigation would no longer entrain so much of the river's volume that it destabilizes the riverbed and produces flow reversals and surges that cause extreme bank erosion.

Areas of Grey Cloud Island that are no longer mined will be reclaimed with native plant communities.

3. RETURN OF NATURAL FLOODPLAIN TO ALLOW MORE HABITAT DIVERSITY

If opportunities arise, independent of this plan, to relocate Industries that are not dependant on the river away from the river, it would be possible to better isolate pollutants from the river to protect against accidental spills. Abandoned dredge material placement sites will be removed or capped and native riparian plant communities restored to re-establish an ecologically functional corridor. Land use in the entire riparian corridor will conform to or exceed the standards established for this area by state standards. The river floodplain throughout this reach will provide critical habitat for wildlife and fish and for humans seeking a quiet experience in a unique and natural setting.

As opportunities arise, floodplain areas filled or developed in an earlier era will be restored to increase flood storage and conveyance. Lilydale Regional Park is a successful example of how this can be done. An increase in the height of the levee at Holmen Field (currently under

discussion) would not be consistent with the goal to reclaim floodplain and improve habitat diversity. Pigs Eye Scientific and Natural Area will be protected to assure that the heron rookery will be sustained. Lower areas of the Phalen Creek floodplain between Warner road and the river will be restored to wetlands. Areas no longer used for barge fleeting will be restored as viable riparian habitats and existing fleeting activities will not be relocated in high quality habitat areas. All redeveloped areas will be designed to have ecological benefits. The riparian corridor will be dominated by native plant species and be set aside for plant and animal habitat. Grey Cloud Island, if developed as a regional park preserve as planned, can provide high-value habitat for wildlife that is dependant on native forests, grasslands and aquatic habitats. Establishment of a Scientific and Natural Area at Pine Bend Bluffs would protect existing floodplain and habitat diversity.

Local enforcement of the state's Mississippi River Critical Area land use standards, park land acquisition and management, and natural resource stewardship on private lands within the pool 2 planning area will contribute to a continuous "green" corridor of wildlife habitat and open space, where ecological functions have been restored, unique natural resources protected and regional biodiversity enhanced. Efforts of nongovernmental groups, as well as local, state and federal agencies, will play a crucial role restoring native plant communities.

Recreational watercraft and barges will operate in a way least damaging to riparian and aquatic habitats.

In order to protect particularly unique or significant resources or ecological features, it may be desirable to acquire land or easements from willing sellers. This would be a long-term effort involving acquisition of title, or floodway and bluff land easements, from willing sellers. Opportunities for acquisition often arise unexpectedly, so it will be important to have flexible funding mechanisms in place in order to act on opportunities. For example, after major floods, landowners who have experienced loss or damage are often interested in selling land or easements. Non-governmental organizations, such as land trusts, can provide expertise and help develop a long-term program for acquisition, as well as leverage funding.

4. PROVIDE FOR SEASONAL FLOOD PULSE AND PERIODIC LOW FLOW CONDITIONS

It is desirable to emulate the natural flow regime to achieve an ecologically functional state reflective of the natural range of flows, water levels and rates of rise and fall that historically occurred on the river. These are the rhythms that aquatic life is adapted to and dependent on for life history queues and successional renewal of plant communities. Recolonization by historically present native fish, mussel species, floodplain forest and aquatic plant communities will follow. Shoreline erosion will diminish under the emulated flow regime and native plant community's influence. Seasonal low water conditions will restore the previously mentioned floodplain lakes by re-establishing their marshy fringe and submersed plant communities. If Lock and Dam 2 operation could be modified to lower the water level, considerable river bottom in the Grey Cloud Island area (Grey Cloud Slough, Mooers Lake, Baldwin Lake), the open areas across from Nininger, and the Spring Lake area would be exposed. This would stimulate the growth of aquatic plants and the rebirth of lost marsh habitats, and improve the health of floodplain forests.

A great deal of sediment has been trapped in the backwater lakes above Lock and Dam 2. It would be desirable to allow low water conditions to occur in order to consolidate the deposits and stimulate recolonization of former marsh and aquatic plant and invertebrate communities.

The process used for planning the Pool 8 drawdown, farther downstream on the Mississippi River, was considered very successful and could serve as a guide for pool 2. The interagency and citizen's Water Level Management Task Force has taken a lead role in the Pool 8 drawdown and is obtaining technical information on how to implement a drawdown project in other pools. This information could be useful in determining the suitability of a drawdown in pool 2. The extent

of drawdown would depend on cost and desires of the public. A drawdown would be implemented as soon as possible and be repeated as necessary to maintain emergent aquatic vegetation. Small-scale drawdowns will be used to manage lakes in the Minnesota Valley National Wildlife Refuge that now receive too much water because of accelerated agricultural and urban runoff.

5. RESTORE BACKWATER/MAIN CHANNEL CONNECTIVITY

In the desired future, the original channel of the Minnesota River will again convey some flow, revitalizing this backwater. The floodplain lake characteristics of Pickerel Lake will be restored. To prevent the degradation of plant and animal communities in Upper Grey Cloud Channel, this area will remain isolated until water quality improves sufficiently to prevent resource degradation. Once this is achieved, the downstream portion of this channel will be restored to a natural flowage. The natural river levees that once surrounded Spring Lake and other floodplain depression areas will be restored.

6. MANAGE SIDE CHANNELS; CREATE ISLANDS, SHOALS AND SANDBARS

Some of the best and most diverse habitat in the Upper Mississippi River is associated with the mosaic of small flowing channels, ponds, sloughs, and natural levees. Modification or removal of wing dams could increase the river's ability to create and maintain these features. Flows through side channels that have been blocked to aid channel maintenance will be reopened where possible. Side channels that have been submerged by impoundment or filled by sediment will be restored in order to convey flows sufficient to sustain their form and function. In the lower part of the pool, augmenting natural levees through sediment and flow regime management and subsequent revegetation will restore the historic pattern of channels and native plant communities.

A return to more natural water level variation will allow aquatic plants to re-establish in the shallow areas and expand the area of marsh within backwaters and surrounding the lakes. It will make more sandbar habitat available for fish, wildlife and human use.

Islands would be constructed using 1891 river charts and historic aerial photos as a template, combined with current bathymetry and flow information. Islands may be designed to grow naturally from sediments transported and deposited by the river and/or by utilizing dredge material generated from Corps of Engineers channel maintenance activities to construct islands in the lower, open water area of pool 2. Methods of constructing islands would be based on what has been successful in other Mississippi River pools. Reconstructed islands could be topped with substrate generated by dredging historical fish wintering areas. Dredging these areas would increase water depths and improve fish wintering habitat. Islands would be seeded with native grasses and trees.

Reconstruction of islands and reestablishment of vegetation will reduce wind fetch and wave action, allowing these features to persist. More natural water levels will also redefine the side channels, periodically sweeping away accumulated fine sediments. These restored features will benefit aquatic life and migrating birds and provide additional recreation opportunities for humans. Boats and barges will operate in a way that does not damage these features.

7. MANAGE CHANNEL MAINTENANCE AND DREDGED MATERIAL PLACEMENT

It will be desirable to use dredged material to reconstruct islands and other physical forms that have been lost to erosion, such as islands between Newport and Pine Bend. Dredged material not used for this purpose will be used outside the floodplain or capped with soil capable of

supporting native plant communities and seeded with native species. Abandoned dredge material placement sites will also be revegetated. Channel maintenance operations will include emulating the natural range of water level variability at critical times for plant succession and renewal. Channel training structures will be modified or removed to redistribute energy along the main channel and side channels.

8. SEVER PATHWAYS FOR EXOTIC SPECIES

This reach of the Mississippi River currently supports only a few zebra mussels. To prevent zebra mussels from becoming a severe problem in the future, their import into to this reach by boats or barges will be eliminated by implementing measures to control the species. Other exotic species will also be controlled or eliminated from the area. The Great Lakes pathway for aquatic exotic introductions to the Mississippi River will be severed using physical, technological, and/or biological means.

9. PROVIDE NATIVE FISH PASSAGE AT DAMS

Fish passage through Lock and Dam 2 is made especially important by the infrequent raising of the dam gates that block fish movement. Eliminating or substantially reducing this barrier will allow for fish passage past the dam with greater frequency and ease for all species of river fish. Construction of a long spillway through the dam could create negotiable rapids for migratory fish. Potentially, a connecting channel could be established on either side of Lock and Dam 2 to create rapids that would allow fish to pass between these pools.

DESIRED FUTURE HABITAT CONDITIONS "MAP"

The following map depicts possible future habitat conditions for pool 2. River managers familiar with this section of the Mississippi River developed the map.